Artificial Intelligence and Law (2007)
DOI 10.1007/s10506-007-9027-3

Legal ontology of sales law application to ecommerce

JOHN BAGBY and TRACY MULLEN
Pennsylvania State University, University Park, PA 16802, USA
E-mail: jbagby@ist.psu.edu; E-mail: tmullen@ist.psu.edu

Abstract. Legal codes, such as the Uniform Commercial Code (UCC) examined in this article, are good points of entry for AI and ontology work because of their more straightforward adaptability to relationship linking and rules-based encoding. However, approaches relying on encoding solely on formal code structure are incomplete, missing the rich experience of practitioner expertise that identifies key relationships and decision criteria often supplied by experienced practitioners and process experts from various disciplines (e.g., sociology, political economics, logistics, operations research). This research focuses on the UCC because it transcends the limitations of a formal code, functioning essentially as a composite. AI work can benefit from real-world codes like the UCC, which are essentially formal codes enlightened from a more realistic experience-base from centuries of development in international commercial transactions settings. This paper then describes our initial work in converting an expert system on the U.S. law governing the sale of goods from Article II of the Uniform Commercial Code (UCC), into a knowledge-based system using the Web Ontology Language OWL.

Key words: legal ontology, uniform commercial code

1. Introduction

Artificial intelligence (AI) techniques have spread only slowly into the domains of law, regulation and public policy. From time to time, prototype expert systems are devised but many provide, at best, mixed results. The perspective of this research is that artificial intelligence in law is inherently interdisciplinary. Successful projects in artificial intelligence and ontologies require domain expertise in both law and artificial intelligence. Domain expertise in law is derived from two sources: legal experts in the formal law and process theorists representing various disciplines. Codes, such as the Uniform Commercial Code (UCC) examined in this article, are good points of entry for AI and ontology work because of their more straightforward adaptability to relationship linking and rules-based encoding. However,

Journal : ARTI 10506 Dispatch : 17-1-2007 Pages : 16
Article No. : 9027 ☐ LE ☐ TYPESET
MS Code : ARTI 13 ☑ CP ☑ DISK

approaches relying on encoding solely on formal code structure are incomplete, missing the rich experience of practitioner expertise that identifies key relationships and decision criteria often supplied by experienced practitioners and process experts from various disciplines (e.g., sociology, political economics, logistics, operations research). This research focuses on the UCC because it transcends the limitations of many formal codes, functioning essentially as a composite largely due to the UCC's rather unique heritage. The UCC was derived from the Law Merchant and Lex Mercatoria, codifications of actual practice rather than normative codes drafted by inexperienced legislators. Therefore, AI work on real-world codes like the UCC is benefited by the straightforward coding advantages of codes but enlightened with a more realistic experience-base from centuries of development in international commercial transactions settings. This paper then describes our initial work in converting an expert system on parts of the law governing the sale of goods, Article II of the Uniform Commercial Code (UCC), into a knowledge-based system using the Web Ontology Language OWL with Jess as our inference engine.

2. Related Work

Legal ontologies are a key technology enabling semantic representation and reasoning about legal domains (Schweighofer and Liebwald 2005). Research on extending standard ontologies into the legal domain span the range from core ontologies (e.g., LRI-Core, Breuker 2004), normative ontologies (e.g., NM-L, Shaheed et al. 2005), professional legal knowledge ontologies (e.g., OPJK, Casanovas et al. 2005), or focused on sub-domains ontologies such as intellectual property rights (Gil et al. 2005). Additional challenges arise when considering the multi-language aspects of legal terms (Peters et al. 2005). These ontologies provide the ability to incorporate social and organizational roles and responsibilities (Royakkers et al. 2005; Boella and van der Torre 2005), causal relationships (Hoekstra and Breuker 2005), and norms (Boer et al. 2005) are required to support sound representation and reasoning. In our UCC domain, the ability to represent and reason about roles is crucial. Buyers and sellers, merchants and non-merchants have different roles, rights, and responsibilities in commercial transactions. For example, merchants are assumed to have more knowledge and resources to anticipate and to address any issues that arise during commercial activities. In addition, commercial activities generally involve collective organizational obligations. Hafner (Hafner 1987) has described aspects of conceptual organization necessary in the UCC domain, including the domain knowledge model. Finally, legal tools and methodologies are needed to support the general adoption of this research. The eGanges system (Gray 2005) provides a legal expert shell

Journal : ARTI 10506	Dispatch : 17-1-2007	Pages : 16
Article No. : 9027	☐ LE	☐ TYPESET
MS Code : ARTI 13	☑ CP	☑ DISK

environment, and LODE (Aoki et al. 1998) is a legal ontology development tool. TERMINAE provides a construction methodology (Despres and Szulman 2005) for composing micro-ontologies into a single composite ontology. LawBot uses agents and ontology-augmented search to help those outside the legal profession acquire legal information (Debnath et al. 2000).

3. Some Commercial Successes in Developing Legal Ontologies

Despite the enormous hurdles to comprehensive and robust AI in the domains of law, regulation and public policy, some interesting experiments have been conducted and a few notable functional systems are operative. For example, there are some complex but deterministic systems successfully deployed in specific sub-domains of law, regulation and public policy. Consider the rules-based systems in commercially available tax preparation applications, some running as native software and others successfully operating from online applications service providers (ASP) – the latter including government as the ASP: the United States (U.S.) Internal Revenue Service (IRS). Rather considerable progress in user assistance has characterized the primary legal research databases (Lexis, Westlaw) in the U.S. Online legal databases leverage the traditional categories in law and regulation, develop and deploy cross-reference links, expand computer-aided search through natural language, filters and sense-making. Moving from legal categories to legal ontolgies is a non-trival task that may be supported through the use of XML (Lachmayer and Hoffman 2005; Biagioli and Turchi 2005). Finally, there are numerous electronic government transaction processing systems throughout the world. For example, many taxing authorities assist taxpayers with AI technologies, licensing authorities process transactions, intellectual property (IP) authorities provide research assistance and manage complex processing of application transactions, grants of rights, ownership search, etc.

New services developed by legal research databases may be good predictors of successful AI and ontology work in law for three reasons. First, they already have deployed AI research assistance as discussed above. Second, as private-sector, for profit information service providers, they can be expected to invest in AI innovation where there is reliable cash flow potential. Third, they are already fulfilling the promise of AI in large, complex environments by providing context-sensitive advice on information seeking, including significant access to actual reliable sources. For example, the online legal database services have mechanized and are enhancing traditional finding strategies, although largely using variations and context sensitive enhancements of key word in context search and retrieval. Nevertheless, these services are adding functionality, such as natural language queries rather than exclusively traditional Boolean approaches, with relevance prioritization and

Journal : ARTI 10506 Dispatch : 17-1-2007 Pages : 16
Article No. : 9027 ☐ LE ☐ TYPESET
MS Code : ARTI 13 ☑ CP ☑ DISK

reliability measures, and pragmatic resumption of prior line of research and reasoning. Of particular importance are context-sensitive and tangentially-linked relations to supplementary information. The most recent AI advances permit users to easily access context-sensitive and subject-sensitive information that broaden the user's understanding more efficiently and completely. AI contributes greatly to human expert analysis by organizing terabytes of esoteric information, providing mechanized search and retrieval and providing expert assistance for further information seeking and retrieval.

4. Challenges Developing AI in Law

The development of more complex, reasoning-based applications in law, regulation and public policy may be impeded by the structure of legal knowledge. Law is generally unlike many other learned professions and scientific domains that have knowledge bases derived from empirical research and consensus heuristics generally proven to work well. Clearly law is an open-textured domain that requires more sophisticated AI techniques to classify, link and automate reasoning in the domains of law, regulation and public policy. For these reasons, further AI developments in law, regulation and public policy may require much more concentrated effort in representing legal rules, case interpretations and practitioner insights in ontologies.

There are constraints on expert systems and AI applications where they may impact the rights of individuals or entities. While judgments or decisions resulting from AI inference hold promise for improving human reasoning, particularly from the exhaustive capacity for search, it can be expected that early AI efforts in law will be imperfect as a complete substitute for the advice of experienced human practitioners (Hassett 2000). For example, Lamkin found that there may be legal liability for the owner or operator of an expert system in medical information and that this could lead to liability for misdiagnosis or other treatment errors (Lamkin 1994). No reasonable basis for distinction from the medical context exists to shield AI systems in law from similar liability for information quality or even malpractice.

Judge Posner provides relevant clues into the difficulties any AI system will likely have in producing accurate predictions of legal outcomes or even helping to identify the reasoning that might lead to decisions in legislation, regulatory action or litigation. His comments are sobering for building ontologies with a primary view to providing efficient solutions, essentially relegating them to assistants useful in organizing and seeking information.

> "The first step in deciding a tough antitrust case, a case not controlled by precedent, is to extract (not – it goes without saying – by a deductive process), from the relevant legislative texts and history, from the insti-

Journal : ARTI 10506 Dispatch : 17-1-2007 Pages : 16
Article No. : 9027 ☐ LE ☐ TYPESET
MS Code : ARTI 13 ☑ CP ☑ DISK

> tutional characteristics of courts and legislatures, and, lacking definitive guidance from these sources, from a social vision as well, an overall concept of antitrust law to guide decision. ... All this is true; and it is right to emphasize, against the facile skepticism that is merely the opposite (and equally untenable) pole of syllogism-mongering, that even though interpretation is neither a logical nor a scientific process it yields true understandings in most cases, including most legal cases" (Posner 1998).

Most of the existing AI experiments in law recognize that this enormity of legal knowledge is derived from formal law in constitutions, statutes and regulations; as interpreted by case law precedents; and finally interpreted through the experience of many domain experts. Law differs in states/provinces, among nations and between affiliated trading groups in international commerce. Law libraries are filled with statutes, legislative history, regulations and cases issued by thousands of discrete authorities. Nevertheless, undaunted, many computer and information scientists as well as legal scholars have chosen to break law down into manageable-sized sub-domains more susceptible to internal consistency and coherence and less effected by external domains. For example, Groothuis postulates that expert systems could be constructed to provide advice and decision support for sub-domains such as the government administered social insurance experiment in the Netherlands (Groothuis 2002). Another working experiment includes the decision support application of expert systems in New York to assist prosecutors in choosing from among many cases for the investment of resources such as investigators, attorneys and office staff (Hassett 2000). Yet another narrow domain example is the assessment of evidence in litigation by Levitt and Laskey (2001).

5. Toward Legal Ontologies Accurately Reflecting both Formal Rules and Actual Practice

AI and ontologies in the law hold strong promise to organize legal research, as well as inform legal reasoning for improving the quality of legal decisions, advice and research. According to Rissland: "AI focuses a spotlight on issues of knowledge and process to a degree not found in non-computational approaches" (Rissland 1990). Accurate representation of the law is essential to meaningful and useful AI in law. According to Aikenhead "It is obviously a prerequisite to know what the nature of law is and what the process of legal reasoning involved before incorporating legal knowledge in a computer and making the computer manipulate that knowledge to emulate the legal reasoning process, i.e., the results achieved by lawyers" (Aikenhead 1996).

Journal : ARTI 10506 Dispatch : 17-1-2007 Pages : 16
Article No. : 9027 ☐ LE ☐ TYPESET
MS Code : ARTI 13 ☑ CP ☑ DISK

Legal ontologies become robust only in as much as they are able to enrich the more deterministic structure of context and interpretation available in statutory law. Case interpretations are a fundamental difference between the law of nations adhering to the common law approach (nations deriving legal traditions from England) and the nations using the civil law approach (nations adhering to the largely legislative approach of the continental European nations and the nations they colonized). In modern practice around the world, the governing statutes are the starting place for AI work.

There are two levels of domain knowledge beyond the formal statutory framework that are relevant for robust AI in law. First, the case law interpretations, just mentioned, add authoritative detail but are subject to interpretation. Second, heuristics of seasoned practitioners, regulators, litigators, judges, legislators, sociologists, and political economists can all provide relevant heuristics. For example, Aoki et al. used an existing general ontology enhanced by a case ontology automatically constructed from precedents input by the user in international commerce governed by the Vienna Convention on the International Sale of Goods (CISG) (Aoki et al. 1998).

By providing an explicit representation of the semantics for domain concepts and properties, ontologies can be used for knowledge sharing and reuse among both humans and software agents. In the Semantic Web vision (Berners-Lee et al. 2001), humans and computers can easily collaborate because the necessary information and process knowledge has been given a well-defined meaning that allows for intelligent automation by software agents. Research efforts in the legal domain, aimed at fostering a semantic web approach, have taken on the problem from two different, but complementary, directions. Kabilan and Johannesson (2003) focus on building a ‘‘lawyer’s ontology’’. They conform to the legal terms and rules drawn from international contract law, and represent those in a conceptual model using the Unified Modeling Language[1] (UML). UML can then be transformed into various semantic web ontology languages. SweetDeal (Grosof and Poon 2003) embraces the ‘‘law in practice’’ or process-based approach based on actual practice for representing legal contracts. They use the MIT Process Handbook, which details business process knowledge actually used by industry business process designers, and represent the business process knowledge using semantic web languages such as DAML + OIL[2] and RuleML.[3] With this information accessible, intelligent software agents can play a larger potential role in automating creating, assessing, negotiating and performing such contracts.

The accuracy, relevance and predictability of AI in law is enhanced with detail provided in cases and judgments derived from experienced experts who can provide heuristics based on probability assessments. Legal ontologies are improved with experience. Baker argues for the superiority of experiential learning, citing creation of AI ontologies ex post as inferior source of for human learning (Baker 1994).

Journal : ARTI 10506 | Dispatch : 17-1-2007 | Pages : 16
Article No. : 9027 | ☐ LE | ☐ TYPESET
MS Code : ARTI 13 | ☑ CP | ☑ DISK

6. Toward Commercial Law as an Optimal Blend of Formal Specificity and Reliable Compilation of Experience

Although this may soon change, few statutes have ever been written intending to be searched, analyzed or modified by computers, other than with simple word processors. The benefits of having a domain designed with modular organization are simply non-existent in most national laws and highly unlikely to be constructed in the near to medium term for industrialized nations. Blackwel argues for the benefits of object-oriented analysis and design in AI as an ideal structure for analysis of problems involving "complex relationships among distinct concepts. [Such a] structure will allow close consistency with both the real-world situations addressed, and the legal principles applied, by the statute" (Blackwel 1999).

Nevertheless, the organization of some statutes transcends the hodgepodge, historical accumulation of political compromises often typified by the Internal Revenue Code in the U.S. Indeed, the Law Merchant and its progeny, the U.S. Uniform Commercial Code (UCC), separately legislated by all 50 U.S. state legislatures, is a model of two important factors that may improve its potential for adaptation through ontologies into AI systems. First, the UCC is composed of well-organized rules derived from best practice experience from centuries of actual conduct. The UCC is therefore a codification following practice significantly bridging the gap between prescribed conduct and actual behavior. As a result, an ontology based on the UCC is already more robust because it includes many details from experience. Second, the UCC has a form of modular composition, again derived from experience, enabling manageable analysis and ontological representation. The CISG is very similar to the UCC, and increasingly promises to apply the benefits of this model's generality to the sale of international goods and the ecommerce commerce domains.

7. Our Model Transformation

In day to day legal practice, processes are derived from both the existing law, from experience, and from various cultural, political, and economic factors. When the law must be applied to new areas, such as ecommerce, the law relies on both extending past standards and on incorporating new business practices through a case-by-case "learning" process. We believe that both approaches are naturally linked, and that they must be for the semantic web vision to be achieved in the area of contract law. As our first step, we focused on building a composite "lawyer's ontology" refined with law from actual practice because of the unique hybrid capabilities offered by the US-based UCC commerce code.

Journal : ARTI 10506 Dispatch : 17-1-2007 Pages : 16
Article No. : 9027 ☐ LE ☐ TYPESET
MS Code : ARTI 13 ☑ CP ☑ DISK

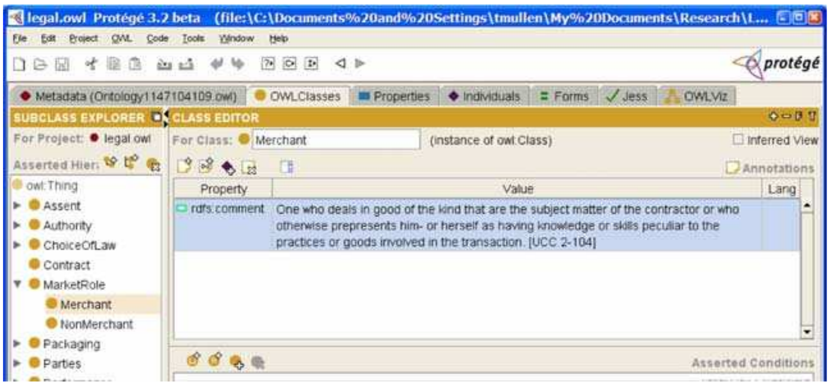

Figure 1. Example of UCC-derived Term Definition for the term Merchant.

The starting point for our work is a series of UCC-based expert systems built in the late 1980's (Bagby 1987). These expert systems evaluate contract performance, and suggest possible remedies for various kinds of non-performance. They are used by lawyers and commercial contracting professionals (e.g., purchasing managers, sales staff) who understand basic domain concepts such that every contract involves a buyer and seller, each of whom can be either merchants or non-merchants, and so forth. Thus our first step in transforming these expert systems into knowledge-based systems requires incorporating the de jure formal terms and rules in the UCC Article II into a legal ontology.

We developed our ontology using the OWL Web Ontology Language [4] in Protégé (Noy et al. 2001), an open-source development environment for ontologies. An OWL plugin, provided in the Protégé download, extends the Protégé development environment to support OWL. When possible, we document each term's usage in UCC Article II by its section number. In Figure 1, we show the paraphrased description for the term Merchant and its UCC citation [UCC 2-104]. Ideally, in the future, we would be able link to a Legal Dictionary such as LEXML[5] the European Legal RDF Dictionary. Figure 2 shows our current prototype UCC ontology displayed graphically. Our next step is to drive the development of the ontology using a hypothetical case, see Section 8 below.

8. Testing the Ontology Using Simulation

In this section, we test the ontology using a hypothetical derived from a influential, watershed case in electronic licensing for software "products." Simulation using legal ontologies is a useful tool to (1) assess the robustness of the ontology, (2) identify weaknesses with a view to iterative refinement of

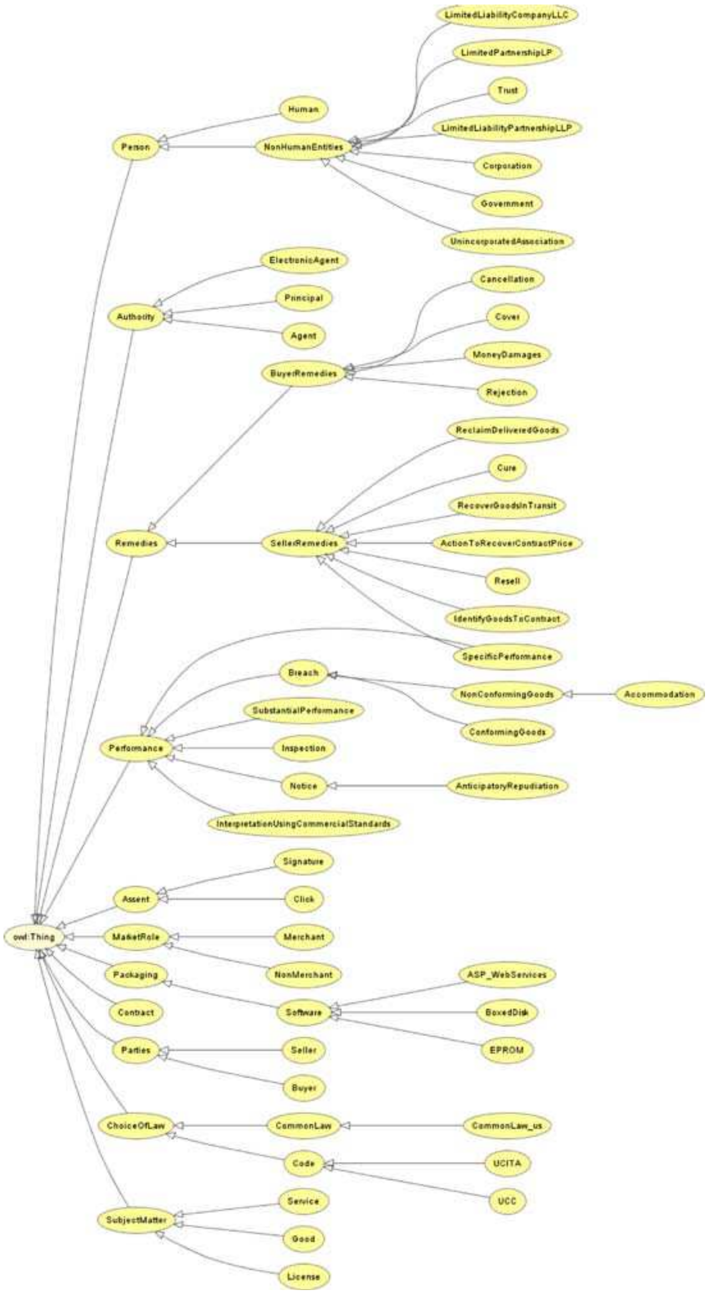

Figure 2. Prototype UCC Article II Ontology.

the ontology and (3) provide data that indicate promising points of departure for the developing and maturing ontology's expansion into related subject areas. The hypothetical used here serves to achieve some progress towards all three of these objectives.

Journal : ARTI 10506 Dispatch : 17-1-2007 Pages : 16
Article No. : 9027 ☐ LE ☐ TYPESET
MS Code : ARTI 13 ☑ CP ☑ DISK

Simulated testing can be performed on legal ontologies by using three broad types of data. The first category are real cases that can be briefed and coded for simulation. Real cases are generally taken from publicly-available and published reporters. In the U.S., these are law books organized under standardized citation methods and are generally available from various public sources. These public sources represent the deciding justice's written account of the procedural case history, facts, decided legal issues and rationale/justification that settle actual disputes between revealed parties and appear "in the public record." The traditional method to archive decided cases and make them available publicly is through print publication generally available in most public and private law libraries as well as in various print archives (e.g., public and federal depository libraries). Increasingly, most such (print) published cases as well as many "unpublished" cases are available electronically through various proprietary online information services (e.g., Lexis, Westlaw), proprietary archival online information services (e.g., CCH, Prentice-Hall, Sweet and Maxwell) and various electronic public domain collections typically available online at law schools and special interest organizations. Electronic resources show great promise for large scale simulation testing of legal ontologies because their largely digital archiving of ascii formatted text in natural language permit key word in context and Boolean search useful in preparing such cases for coding. Many such electronic collections of decided "real" cases are indexed and summarized according to long-term persistent subject taxonomies widely used among legal practitioners. For example, some electronic collections include cases in relational databases that are organized into fields (e.g., jurisdiction, dates, parties, counsel, judges, subject of law, dissenting opinions) and are susceptible to deployment of innovations using other search techniques.

Real cases may be most useful to test the legal ontologies in two contexts. First, real cases can test the robustness of the ontologies when presumed to be "correctly" decided. Under this method, cases without logical flaws or inappropriately applied law assist in identifying and correcting the logic of the ontology. Second, sufficiently revised and debugged legal ontologies can be used to identify and correct real cases decided with logical flaws or inappropriately applied law. This method is useful to identify systematic biases in case outcomes unique to particular influences possibly due to factors such as a particular state's law, particular judges (hanging judge), particular litigants, counsel or expert witnesses, jury selection methods, litigation consultants, perhaps even the role of publicity to channel outcomes. Of course, to enable both contexts, there will persist a pivotal issue as to the correctness in the deciding of cases.

The second broad types of data useful in simulations using legal ontologies are "pure hypotheticals." These are cases not directly derived from real

Journal : **ARTI 10506**	Dispatch : **17-1-2007**	Pages : **16**
Article No. : **9027**	☐ LE	☐ TYPESET
MS Code : **ARTI 13**	☑ CP	☑ DISK

cases, but are composed and invented cases that serve several important purposes, many of which are derived from the original Socratic method. Pure hypotheticals permit simulation when no or too few real cases have ever yet reached a particular node or decision point. This enables a much larger set of alternative to be examined and enables the exploration of complex combinations of factors useful in planning. For example, pure hypotheticals can be constructed to fairly closely parallel a novel but planned transaction. Simulations thus used for planning promise to endow robust ontologies with powerful forecasting accuracy. Thus there are clear benefits to users to fully vent before committing to transaction or publicity (goodwill) risks. Expert systems and other artificial intelligence researchers have long promised such planning benefits.

The third broad type of data useful in simulations using legal ontologies is used here – a hybrid of the first two, herein called "real case enhanced hypotheticals." We chose to combine the benefits of real cases and hypotheticals by re-writing a real case to include additional, but hypothetical factors, to create the hybrid. The real case enhanced hypothetical used here is based on the *Netscape v. Specht* eCommerce contracting case described and "briefed" as follows:

> Netscape's SmartDownload facility had no requirement that the user must through an agreement button to view terms and conditions before beginning the download. Other Netscape functions or products required agreement before downloading. Netscape's software captured private information about users' surfing habits, arguably in violation of federal electronic surveillance privacy rights.
>
> *Legal Issue*. Are arbitration provisions in Web site terms and conditions enforceable against users if they are not clearly directed to assent to such terms?
>
> *Opinion*. On-line contracting is subject to traditional contract formation rules requiring knowing acceptance of terms. The Uniform Commercial Code applies to software download contracts. Click-wrap and shrink-wrap contracts are enforceable because the user manifests assent clicking through the "I accept" box. However, no clear click-wrap or shrink-wrap agreement between Netscape and users of Smart Download. Users were not required to manifest assent terms before downloading. Netscape used a mere invitation to visit terms on a linked page, was not enough to alert users that these terms were a condition to downloading. The act of downloading is not an unequivocal indication of assent; it is more like accepting a free sample (Bagby 2002).

Journal : ARTI 10506 | Dispatch : 17-1-2007 | Pages : 16
Article No. : 9027 | ☐ LE | ☐ TYPESET
MS Code : ARTI 13 | ☑ CP | ☑ DISK

In this case, the first essential step is the choice of law. But this depends on whether the software is classified as a good, a service, or as a licensing of content. For a software vendor, or a consumer, the choice of law can result in quite different outcomes. In the U.S., the UCC only applies if the subject matter is goods, and not to services (use common law) or licenses (use UCITA or UCITA-like code). When software subject matter (e.g., good, service, licensing of content) is known, then the system can select the appropriate choice of law to evaluate the contract and its potential weaknesses. Alternatively, the user may wish to consider what happens if their software contract is evaluated under a different subject matter, and thus a different choice of law. This might lead them to market the software as a service or a license instead of a product, or vice versa. Below we describe our first simple steps in supporting this kind of recommendation analysis.

While our OWL ontology allows us to classify instances, it does not allow us to inference, or reason, over the classes. We use Jess Eriksson 2003), a Java expert system shell, to reason over our ontology. Protégé provides a JessTab plugin[6] that maps ontologies into Jess. Once the ontology has been represented in Jess, we can use inference rules to derive choice of law requirements, see Figure 3. JessTab extends Jess with functions, such as *mapclass*, that map a Protégé ontology into Jess facts, and properties, see Figure 4 for Contract properties, into Jess slots. Jess also provides functions for manipulating Protégé knowledge bases. One example of such a function is *class-subclasses*, which returns the Jess facts that are the subclasses of a given class.

From our hypothetical case above, users with (1) a contract with subject matter of *Good*, have a choice of law *UCC*, or (2) any contract for which the users want to apply *UCC* laws must have a subject matter of *Good*. Clearly the ontology and Jess rules applies for similar questions about when to apply


```
(mapclass ChoiceOfLaw)
(mapclass Contract)
(mapclass Packaging)
(mapclass SubjectMatter)
        …
 (defrule hypothetical-from-Netscape-v-Specht
        ?c <- (object (is-a :(instance-of ?c Contract))
                (hasPackaging ?pk) (hasChoiceOfLaw nil)(hasSubjectMatter nil))
        (test (> (length$ (class-subclasses (class ?pk))) 0))
    =>
        (bind ?pk_subclass (class-subclasses (class ?pk) inherit))
        (recommend-hypotheticals ?c ?pk ?pk_subclass))
```

Figure 3. Example of mapping classes to Jess + Jess rule.

Journal : ARTI 10506 | Dispatch : 17-1-2007 | Pages : 16
Article No. : 9027 | ☐ LE | ☐ TYPESET
MS Code : ARTI 13 | ☑ CP | ☑ DISK

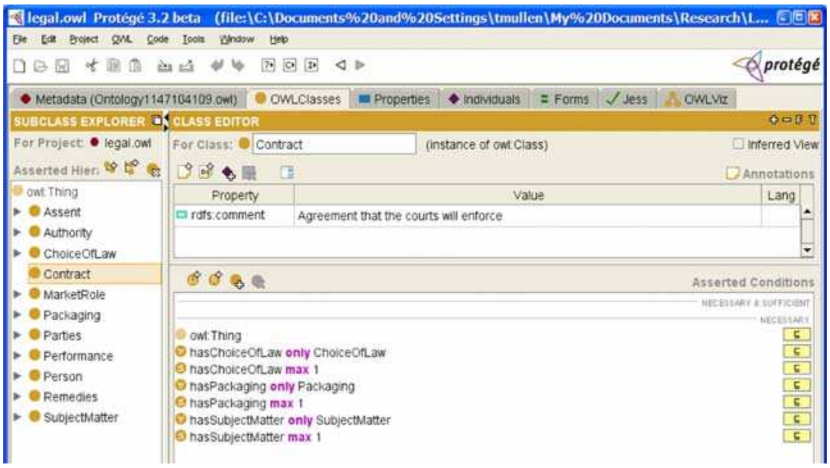

Figure 4. OWL Contract properties.

common law (land or services), UCITA (licensing of content), or any other *ChoiceOfLaw* encoded into the ontology. In the case of software, *Packaging* determines the subject matter, and hence the choice of law. In the case of software, packaging includes *EPROM*(e.g., software included on an EPROM in a car), *ASP_WebServices*, and *DiskInBox*, where EPROM packaging has a subject matter of goods, ASP_WebServices has services, and DiskInBox has license. Of course, other factors such as Jurisdiction play a role in determining the subject matter, and we will expand to include additional factors in future versions.

Figure 5 shows an example of the contract *contract1* after the user has selected *hasPackaging* of *EPROM_1*. Using the Jess rules above, the system will then set *hasSubjectMatter* property to *Good* and *hasChoiceOfLaw* to *UCC*. At that point the system can analyze the contract using the UCC contract requirements. However, suppose the user does not realize the impact that different packaging can have on the final legal choice of law. In this case, the user would select the higher level packaging of Software. Since software can be either a good, service, or license, depending on how it is packaged, the system informs the user of the possible choices, see Figure 6. The user can then explore the implications resulting from those selections. We are currently working on supporting the user in this selection process by providing information about pros and cons of each choice and highlighting relevant cases (such as *Netscape v. Specht*).

9. Conclusion

In this paper, we describe our initial research investigation into representing the UCC commercial laws as a legal ontology. Once this work is completed,

Journal : ARTI 10506 Dispatch : 17-1-2007 Pages : 16
Article No. : 9027 ☐ LE ☐ TYPESET
MS Code : ARTI 13 ☑ CP ☑ DISK

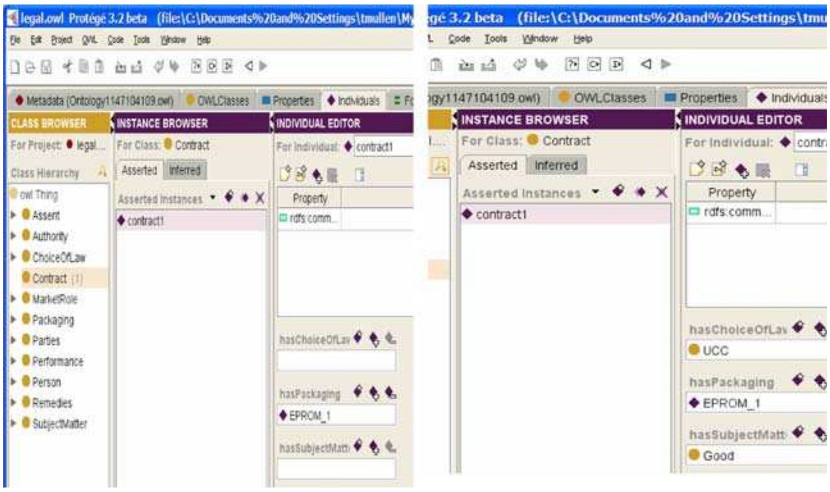

Figure 5. User selects *hasPackaging* of *EPROM_1*: Before and after inferencing.

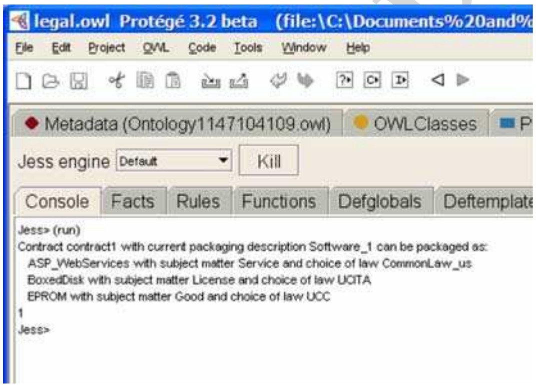

Figure 6. User is informed via Jess about possible Choice of Law options.

the authors plan on extending the UCC commercial laws into the emerging rules of electronic commerce with a view to examining the implications to planning, execution, and dispute resolution for electronic commerce transactions. For example, three frameworks in international commerce appear to be natural objects to extend this method. First, the Vienna Conventional for the International Sale of Goods (CISG) has many notable similarities to the Law Mechant, Lex Mercatoria and the UCC particularly as compendiums of successful actual practice. Second, several sources of electronic commerce laws have been implemented in the European Union and the United States. For example, the EU Directive in Electronic Commerce (Dir 2000/31/EC) and the Uniform Electronic Transactions Act (UETA) are developing sufficient rigor to deserve attention, particularly given their focus on automated transactions, concluded by electronic means including electronic agent

Journal : ARTI 10506 | Dispatch : 17-1-2007 | Pages : 16
Article No. : 9027 | ☐ LE | ☐ TYPESET
MS Code : ARTI 13 | ☑ CP | ☑ DISK

activities. Follow on work will address the impact of deploying intelligent software agents as full-fledged legal persons engaged in these types of transactions.

Notes

[1] www.uml.org
[2] www.w3.org/TR/daml + oil-reference
[3] www.ruleml.org
[4] www.w3.org/2001/sw/webont
[5] www.lexml.de/rdf.htm
[6] http://www.ida.liu.se/~her/JessTab/

References

Aikenhead, M. (1996). The uses and abuses of neural networks in Law 12, Santa Clara High Tech Law Journal.

Aoki, C., Kurematsu, M., and Yamaguchi, T. (1998). LODE: A Legal Ontology Development Environment.

Bagby, J. (1987). Artificial Intelligence in Sales Law: A Decision Analysis Approach to Commercial Transactions, Center for Research, College of Business, The Pennsylvania State University 87–1.

Bagby, J. (2002). e-Commerce Law: Issues for Business.

Baker, B. (1994). Beyond Maccrate: The Role of Context, Experience, Theory and Reflection in Ecological Learning, 36 Arizona Law Review 287.

Berners-Lee, T., Hendler, J., and Lassila, O. (2001). The Semantic Web, in Scientific American.

Biagioli, C. and Turchi, F. (2005). Model and ontology based conceptual searching in legislative XML collections, Presented at ICAIL Workshop on Legal Ontologies and Artificial Intelligence Techniques (LOAIT).

Blackwel, T. F. (1999/2000). Finally Adding Method to Madness: N1 Applying Principles of Object-Oriented Analysis And Design To Legislative Drafting, 3 N.Y.U. J. Legis. & Pub Pol'y 227.

Boella, G. and van der Torre, L. (2005). The Ontologicial Properties of Social Roles: Definitional Dependence, Powers and Roles Playing Roles, Presented at ICAIL Workshop on Legal Ontologies and Artificial Intelligence Techniques (LOAIT), Bologna, Italy.

Boer, A., van Engers, T., and Winkels, R. (2005). Normative Statements on the Semantic Web, Presented at ICAIL Workshop on Legal Ontologies and Artificial Intelligence Techniques (LOAIT), Bologna, Italy.

Breuker, J. (2004). Constructing a legal core ontology, presented at Workshop on Ontologies and their applications.

Casanovas, P., Casellas, N., Tempich, C., Vrandecic, D., and Benjamins, R. (2005). OPJK modeling methodology, Presented at ICAIL Workshop on Legal Ontologies and Artificial Intelligence Techniques (LOAIT), Bologna, Italy.

Debnath, S., Sen, S., and Blackstock, B. (2000). LawBot: A Multiagent Assistant for Legal Research, IEEE Internet Computing 4: 32–37.

Journal : ARTI 10506 Dispatch : 17-1-2007 Pages : 16
Article No. : 9027 ☐ LE ☐ TYPESET
MS Code : ARTI 13 ☑ CP ☑ DISK

Despres, S. and Szulman, S. (2005). Merging of Legal Micro-ontologies from European Directives, Presented at ICAIL Workshop on Legal Ontologies and Artificial Intelligence Techniques (LOAIT), Bologna, Italy.

Eriksson, H. (2003). Using JessTab to Integrate Protege and Jess, IEEE Intelligent Systems Journal 43–50.

Gil, R., Garcia, R., and Delgado, J. (2005). An interoperable framework for intellectual property rights using web ontologies, Presented at ICAIL Workshop on Legal Ontologies and Artificial Intelligence Techniques (LOAIT), Bologna, Italy.

Gray, P. N. (2005). Ontology and Epistemology in Legal Knowledge Engineering, Presented at ICAIL Workshop on Legal Ontologies and Artificial Intelligence Techniques (LOAIT).

Groothuis, M. M. (2002). Expert Systems in the Field of General Assistance: An Investigation into Juridical Quality, 52 Syracuse Law Review 1269.

Grosof, B. and Poon, T. (2003). SweetDeal: Representing Agent Contracts with Exceptions using XML Rules, Ontologies, and Process Descriptions, Presented at WWW 2003, Budapest, Hungary.

Hafner, C. D. (1987). Conceptual organization of case law knowledge bases, Presented at 1st International Conference on Artificial Intelligence and Law (ICAIL), Boston, Massachusetts.

Hassett, P. (2000). Essay: Technology Time Capsule: What does the future hold? 50 Syracuse Law Review 1223.

Hoekstra, R. and Breuker, J. (2005). Processes as Causal Glue in a Framework for Ontology-Based Responsbility Attribution, Presented at ICAIL Workshop on Legal Ontologies and Artificial Intelligence Techniques (LOAIT).

Kabilan, V. and Johannesson, P. (2003). Semantic Representation of Contract Knowledge using Multi-tier Ontology, Presented at The first International Workshop on Semantic Web and Databases (SWDB'03), Berlin, Germany.

Lachmayer, F. and Hoffman, H. (2005). From Legal Categories toward Legal Ontologies, ICAIL workshop on legal ontologies and artificial intelligence techniques (LOAIT).

Lamkin, B. H. (1994). Comments: Medical Expert Systems and Publisher Liability: A Cross-Contextual Analysis. 43 Emory Law Journal 731.

Levitt, T. S. and Laskey, K. B. (2001). Symposium: From Theory To Practice: "Intelligent" Procedures For Drawing Inferences In Static And Dynamic Legal Environments: Computational Inference For Evidential Reasoning In Support of Judicial Proof, 22 Cardozo Law Review 1691.

Noy, N. F., Sintek, M., Decker, S., Crubezy, M., Fergerson, R. W., and Musen M. A. (2001). Creating Semantic Web Contents with Protégé-2000, IEEE Intelligence Systems 60–71.

Peters, W., Tiscornia, D., and Sagri, M.-T. (2005). The structuring of legal knowledge in LOIS, Presented at ICAIL Workshop on Legal Ontologies and Artificial Intelligence Techniques (LOAIT).

Posner, R. A. (1998). The Jurisprudence of Skepticism," 86 Michigan Law Review 827.

Rissland, E. L. (1990). Comment: Artificial Intelligence and Law: Stepping Stones to a Model of Legal Reasoning, 99 Yale Law Journal 1957.

Royakkers, L., Grossi, D., and Dignum, F. (2005). Responsibilities in Organizations, Presented at ICAIL Workshop on Legal Ontologies and Artificial Intelligence Techniques (LOAIT), Bologna, Italy.

Schweighofer, E. and Liebwald, D. (2005). Advanced Lexical Ontologies and Hybrid Knowledge based systems: first steps to a dynamic legal electronic commentary, Presented at ICAIL Workshop on Legal Ontologies and Artificial Intelligence Techniques (LOAIT).

Shaheed, J., Yip, A., and Cunningham, J. (2005). A top-level language-biased legal ontology, Presented at ICAIL Workshop on Legal Ontologies and Artificial Intelligence Techniques (LOAIT).

Journal : **ARTI 10506** Dispatch : **17-1-2007** Pages : **16**
Article No. : **9027** ☐ LE ☐ TYPESET
MS Code : **ARTI 13** ☑ CP ☑ DISK